Application of Grey System Theory and Entropy Weight Method in Basketball League Matches

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ABSTRACT

The basketball league issue has always been a concern, and the predictions for each team's next game have also attracted the attention of the audience. Now more and more fans have begun to predict the future of the favorite team. By analyzing the score data of some teams in the past, this paper obtains the appropriate prediction function by constructing the grey system theory model, and then predicts the future performance of the team. At the same time, using the idea of entropy weight method, through the measurement of the weight of each team in a basketball game, and using the idea of combining numbers and figures, the level of each team is qualitatively analyzed through the weight map.

Keywords-- Grey System Theory, Entropy Weight Method, Prediction Function

I. INTRODUCTION

The problem of the basketball league has always been a concern. The league has grown steadily. It is a very important question for the prediction of the future performance of each team in each season and the qualitative analysis of the level of each team. In this year, assume that 14 teams participate in the competition (A, B, C...N), and combine the historical data of 14 teams (assuming 100 groups) for reference, so as to carry out the level of future performance of each team. Forecast and qualitative analysis of the level of each team. This article analyzes the "Basketball League Problem". By making appropriate changes to the data, the gray system prediction model is established by satisfying certain conditions, and the GM (1, 1) model is constructed to organize the historical data of each team. , the prediction function is obtained, so that the prediction of the future comprehensive score can be performed in the short term.

In the basketball league problem, the entropy weight method is used to calculate the information entropy and weight of the comprehensive scores of different teams. The weight of each team in this year's basketball league is measured by weight, and the contrast change image of weights is drawn. The level of each team is qualitatively analyzed through changes in the image.

II. THE ESTABLISHMENT OF THE GREY SYSTEM THEORETICAL MODEL

In the process of model building, we take the A team as an example:

First, establish the historical scoring data model of team A : X_A^0 :

$$X_A^0 = \left(X_A^{(0)}(1), X_A^{(0)}(2), \ldots\ldots, X_A^{(0)}(100)\right) \quad (1)$$

During the preliminary inspection, it was found that if $X_A^{(0)}$ was constructed using the GM (1.1) model, if the conditions of GM (1.1) were not met:

$$e^{-\frac{2}{k+1}} \le \lambda_A(k) \le e^{-\frac{2}{k+2}} \quad (2)$$

Where $\lambda_A(k)$ is the kth order of A.

Since it is necessary to use the data to construct the GM (1, 1) model, and then calculate the data using the translation method, the method is as follows:

Select the appropriate c value to make:

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$$y_A(k) = X_A(k) + c \quad (3)$$

1. Level ratio of the grading ratio test $\lambda_A(k)$:

Calculated as follows:

$$\lambda_A(k) = \frac{y_A^{(0)}(k-1)}{y_A^{(0)}(k)} \quad (4)$$

Further available : $\lambda_A =$ （$\lambda_A(2)$, $\lambda_A(3)$, ……, λ_A（100））

Therefore, the level ratio judgment is made. If all $\lambda_A(k) \in (e^{-\frac{2}{k+1}}, e^{-\frac{2}{k+2}}), k = 2,3,\ldots,100$ is used, it can be used as $X_A^{(0)}$ satisfactory GM (1.1) modeling.

2. Model the GM (1.1) model:

(1) Make an accumulation of the original data $Y_A^{(0)}$, namely:

$$Y_A^{(1)} = (Y_A^{(0)}(1), Y_A^{(0)}(2), \ldots\ldots, \sum_{k=1}^{100} Y_A^{(0)}(k)) \quad (5)$$

(2) Construct data matrix B_A and data vector M_A, namely:

$$B_A = \begin{bmatrix} -\frac{1}{2}(Y^{(1)}(1) + Y^{(1)}(2)) & 1 \\ -\frac{1}{2}(Y^{(1)}(2) + Y^{(1)}(3)) & 1 \\ \vdots & \vdots \\ -\frac{1}{2}(Y^{(1)}(100) + Y^{(1)}(100)) & 1 \end{bmatrix} \quad (6)$$

$$M_A = \begin{bmatrix} X^{(0)}(2) \\ X^{(0)}(3) \\ \vdots \\ X^{(0)}(100) \end{bmatrix} \quad (7)$$

(3) Calculation μ_A^T （Where $M_A = \mu_A B_A$, where μ_A is the parameter vector） :

$$\mu_A^T = (a_A, b_A)^T = (B_A^T B_A)^{-1} B_A^T M_A \quad (8)$$

Through MATLAB, the development coefficient and the ash effect of the prediction equation of the A team can be calculated (the values of a_A and b_A).

(4)Modeling

$$\frac{dY_A^{(1)}}{dt} + aY_A^{(t)} = b \quad (9)$$

Then, the comprehensive score prediction cumulative function after the data shift of team A is obtained:

$$Y_A^{(1)}(k+1) = \left(Y_A^{(0)}(1) - \frac{b}{a}\right)e^{-ak} + \frac{b}{a} \quad (10)$$

Use

$$Y_A(k) = X_A(k) + c \quad (11)$$

Get the comprehensive on-the-spot play score prediction function of team A as:

$$X_A^{(1)}(k+1) = (Y_A^{(0)}(1) - \frac{b}{a})e^{-ak} + \frac{b}{a} - c \quad (12)$$

Through the accumulation function, the prediction of the future comprehensive play score of team A can be obtained.

III. ESTABLISHMENT OF AN EMPIRICAL ANALYSIS MODEL OF ENTROPY WEIGHT

1. The standardization of data processing

For 14 teams, a total of 14 indicators are set:X_1、X_2、X_3 ... X_{14},

Among them, there are: $X_i = \{x_1 \quad x_2 \quad \cdots \quad x_k\}$; assuming that the value normalized for each comprehensive score is recorded as Y_1、Y_2、Y_3 ... Y_{14}, then there are:

$$Y_{ij} = \frac{x_{ij} - \max(x_i)}{\max(x_i) - \min(x_i)} \quad (13)$$

2. Information entropy of comprehensive scoring indicators

By definition, the information entropy of a set of data is recorded as:

$$E_j = -ln(n)^{-1}\sum_{i=1}^{n} p_{ij} ln p_{ij}$$

$$p_{ij} = Y_{ij} / \sum_{i=1}^{n} Y_i \quad (14)$$

If $p_{ij} = 0$

Definition $\lim_{p_{ij} \to 0} p_{ij} \ln p_{ij} = 0$

Furthermore, through information entropy, the historical comprehensive scores of 14 teams are calculated by software, and the information entropy E_1, E_2, $\cdots$, E_k of each team's comprehensive score is calculated.

3. Determine the weight of each team

The formula for calculating the weight:

$$W_i = \frac{1 - E_i}{k - \sum E_i} (i = 1,2, \cdots, k)$$

In turn, we can get the weight of each team in the Chinese CBA league, and then weigh the weights to map the weights, thus qualitatively explaining the level of each team.

IV. CONCLUSION

Using the grey system theory to establish the predictive function of the future comprehensive score of the team in the basketball league, it is possible to make a preliminary prediction of the future comprehensive score. At the same time, through the rationalization of the data, the weight map can also qualitatively analyze each ball. The level of the team.

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